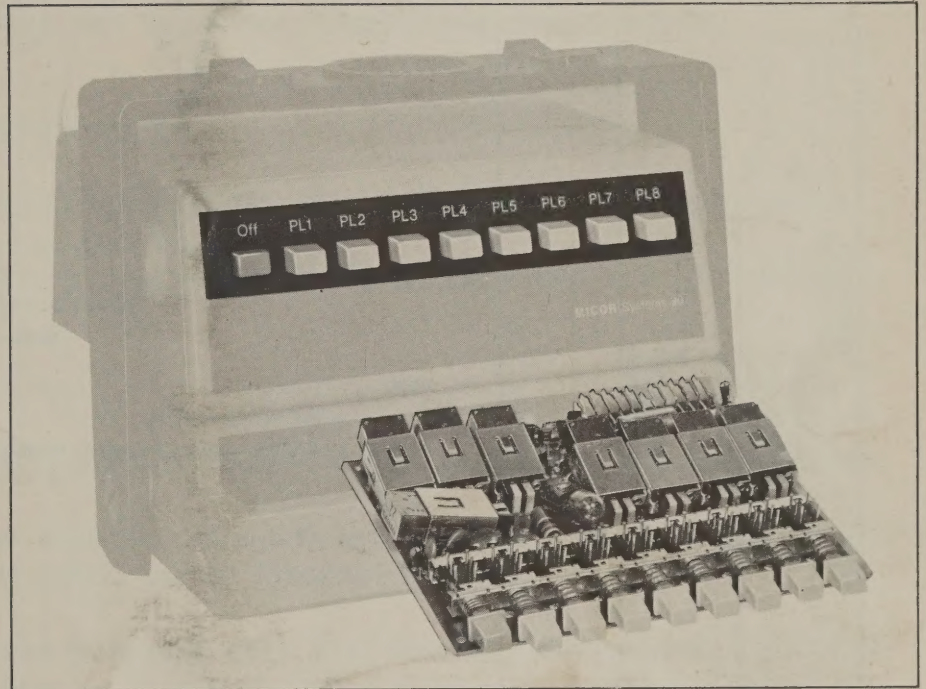




MITREK™ /MICOR™ SYSTEMS•90™

Multiple "Private-Line" Mobile Encoder

Models TLN1837A-TLN1840A,
HLN1004A and HLN1005A



Instruction Manual

68P81106E95-C

TECHNICAL CHARACTERISTICS

MODEL	FOR MITREK RADIOS	HLN1004A	HLN1005A
	FOR MICOR VHF RADIOS	TLN1837A	TLN1838A
	FOR MICOR UHF RADIOS	TLN1839A	TLN1840A
MAXIMUM NUMBER OF TONE FREQUENCIES		4	8
"PL" TONE FREQUENCIES		Selected from 67-210 Hz range	
FREQUENCY DETERMINING DEVICE		"Vibrasender" Resonant Reed	
FREQUENCY STABILITY		± 0.15%	
NOMINAL LEVEL	FOR VHF RADIOS	350 mV rms @ 67 Hz to 130 mV rms @ 210 Hz	
	FOR UHF RADIOS	780 mV rms, 67 to 210 Hz	
OUTPUT IMPEDANCE		4.7k ohms	
POWER REQUIREMENTS		± 13.8 V dc ± 20% @ 200 mA	

Modulator characteristics differ between VHF MICOR (25-50 MHz and 132-174 MHz) and UHF MICOR (450-512 MHz) radio sets. Encoder models are not interchangeable.

MODEL	SUFFIX	DESCRIPTION MICOR MODELS	VHF	UHF	MITREK MODELS
TLN1837A		4-REED ENCODER			
TLN1838A		8-REED ENCODER			
TLN1839A		4-REED ENCODER			
TLN1840A		8-REED ENCODER			
HLN1004A		4-REED ENCODER			
HLN1005A		8-REED ENCODER			

"SYSTEMS 90" MOBILE MULTIPLE "PRIVATE-LINE" ENCODER MODEL AND SUFFIX TABLE

CODE:

● = ONE ITEM SUPPLIED

4 OR 8 = NUMBER INDICATES QUANTITY SUPPLIED

SUB-UNIT	SUFFIX	DESCRIPTION
TLN4527A	1	ENCODER BOARD (4-REED)
TLN4528A	1	ENCODER BOARD (8-REED)
TLN5154A		ENCODER BOARD (4-REED)
TLN5155A		ENCODER BOARD (8-REED)
TLN5733A		CONVERSION BOARD
TLN5734A		CONVERSION BOARD
KLN6210A		"VIBRASENDER" RESONANT REED
TKN6507A		CABLE ASSEMBLY
TLN4514A		HARDWARE & ESCUTCHEON KIT (4-REED ENCODER)
TLN4515A		HARDWARE & ESCUTCHEON KIT (8-REED ENCODER)
HLN4031A	0	ESCUTCHEON & HARDWARE KIT (NOTE 2)
HLN4032A	0	ESCUTCHEON & HARDWARE KIT (NOTE 3)
HLN1009A	0	ENCODER BOARD ASSY.
HLN4030A		RESISTOR KIT (NOTE 1)
TLN5154A		ENCODER BOARD
HLN1010A	0	ENCODER BOARD ASSY.
HLN4030A		RESISTOR KIT (NOTE 1)
TLN5155A		ENCODER BOARD

NOTES:

★ Indicates quantity as specified on order.

1. HLN4030A contains a 27k ± 5%, 1/4 W resistor 6-124A83 which replaces C9 on the encoder board.

2. HLN4031A is identical to TLN4514A except for addition of MITREK option clip.

3. HLN4032A is identical to TLN4515A except for addition of MITREK option clip.



INSTRUCTION MANUAL REVISION

SMR-3947

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

INSTRUCTION MANUAL AFFECTED:

68P81106E95-C "MITREK"/"MICOR" "SYSTEMS 90" Multiple "Private-Line" Mobile Encoder
Models TLN1837A-TLN1840A, HLN1004 and HLN1005A

REVISION DETAILS:

On Schematic Diagram PEPS-1767-B (Sheet 2 of 2), make the following changes:

1. Insert rf coil L1 in the lead that connects between J401, pin 6 (Multiple "PL" Conversion Board) and P901, pin 27 (Control Board).
2. Indicate reference to the following Note 13: Coil L1 used only on TLN5734A UHF Converter Boards.
3. In parts list PL-3302-O, add the following:

		<u>COIL, rf:</u>
L1	24-800484	.31 uH (TLN5734A only)

This change makes TLN5734A version "-1".



MOTOROLA INC.

**Communications
Group**

MITREK™/MICOR™

“SYSTEMS 90”™

MULTIPLE “PRIVATE-LINE” MOBILE ENCODER

1. DESCRIPTION

The mobile multiple “Private-Line” (PL) encoders equip Motorola FM two-way mobile radios for use in several “Private-Line” networks. The Models TLN1837A and TLN1838A Multiple “Private-Line” Encoders are used with “Micor” VHF radio sets and the Models TLN1839A and TLN1840A are used with “Micor” UHF radio sets. Models HLN1004A and HLN1005A Multiple “Private-Line” Encoders are used in the MITREK radio sets. The TLN1837A, TLN1839A and HLN1004A generate up to four PL tones; the TLN1838A, TLN1840A and HLN1005A generate up to eight PL tones. Each encoder is fully solid-state and constructed on two printed circuit boards. One board is a multiple PL conversion circuit board which mounts in the radio set (this board is not required with MITREK radio sets). The other board is a multiple PL encoder circuit board card which slides into a Motorola “Systems 90” option housing. Switches and indicators of the operator’s panel are an integral part of the board, as is the connector on the rear of the unit. All necessary related items, such as interconnecting cable with connector, are included. The housing is ordered separately, since numerous combinations of housings and options are possible.

2. “PRIVATE-LINE” NETWORK

2.1 The use of “Private-Line” tone-coded squelch models improves radio communications especially when operating under crowded channel conditions. Several “Private-Line” networks can use the same rf carrier frequency in the same area without hearing annoying transmissions of co-channel users. Receivers remain silent until a properly tone-modulated signal turns on the audio amplifiers so that messages transmitted by units in the same net can be heard. The speakers remain silent during all other transmissions; personnel do not have to listen to transmissions originating outside their “Private-Line” network.

2.2 Receivers accept only signals which are modulated with the correct tone and reject all others.

“Private-Line” transmitters are modulated by a continuous sub-audible tone in addition to voice modulation. The receivers can also monitor all on-frequency signals by disabling the “Private-Line” tone-coded squelch circuit.

3. INSTALLATION

3.1 FIELD INSTALLTION IN A MITREK SYSTEM

The encoder comes either as a factory equipped option, completely prewired, or as a field installed “add-on” to an existing “MITREK” radio set. The PL encoder circuit board card is installed in the accessory housing, either alone or in combination with other radio accessory options. The installation instructions provided here apply when the encoder is the only accessory. For instructions pertaining to multiple option installations, refer to the installation instructions supplied with the housing assembly.

Step 1. Remove the escutcheon backing and apply carefully to the housing assembly front panel. Use care to align the holes in the escutcheon with the holes in the panel.

Step 2. If the multiple PL encoder is used without full complement of PL tones, the unused pushbutton switches must be pinned, as follows:

(1) Pull the applicable pushbutton plastic cover straight off. A screwdriver may be used to give added leverage.

(2) Install the supplied plastic pushbutton stop.

(3) Push the cover back on the pushbutton switch.

CAUTION

Be sure not to close the switch when replacing the pushbutton cover. Hold the little male slider pin that protrudes from the back of the switch with a small screwdriver and push the cover on. This slider pin is “in” when the switch is “open”.

Step 3. Remove the Black connector P101, the Blue connector P102, the Speaker connector and the Mic connector from the alternate control module.

Step 4. Loosen the two captive screws from the bottom of the "Systems 90" housing and remove the back cover.

Step 5. Place the card into the two rails as shown in Figure 1 and slide the circuit card completely into the housing assembly.

Step 6. Determine which of the knockout panels in the rear housing cover must be removed to allow access to the 22-pin assembly on the board. Remove the panel by pushing it out toward the rear of the cover.

Step 7. Refer to Figure 1. Install the rear housing cover by (1) inserting the tabs on the top of the cover into the holes in the top of the housing assembly and (2) swinging the cover down against the bottom and (3) securing it with the two captive screws.

Step 8. Use the contact removal tool to remove the following wires, with pins attached, from P101 (Black connector).

- Yellow wire from position 1.
- Black-violet wire from position 2.
- Black-orange wire from position 22.

Step 9. Insert the pins and wires which were removed from P101 into the tan connector (P1) as follows:

- Yellow wire into position 13.
- Black-violet wire into position 12.
- Black-orange wire into position 22.
- Black-gray wire (previously tied back) into position 18.

Step 10. Insert the pins and wires connected from P1 into P101 as follows:

- Yellow wire into position 1.
- Black-violet wire into position 2.
- Black-orange wire into position 22.

Step 11. Reconnect P101 to the control head and connect P1 to the 22-pin receptacle (J1) on the rear of the circuit card. Also connect the Blue connector, Speaker connector, and Mic connector to the alternate control module.

Step 12. Open the top cover of the radio following the procedure in the manual.

Step 13. Install the MITREK option clip supplied in the encoder hardware kit on the MITREK interconnect board in position A. Refer to the detail on the interconnect board circuit board diagram in the radio manual for particulars; note that this detail is shown from the solder side of the board.

NOTE

For details on positive ground installations refer to the Positive Ground Installations panel on the MITREK SYSTEMS 90 Installation Sheet 68P81109E49.

3.2 FIELD INSTALLED IN A MICOR RADIO

The encoder comes either as a factory equipped option, completely pre-wired, or as a field installed add-on to an existing "Micor" radio set. The conversion circuit board is installed in the "Micor" radio set. The PL encoder circuit board card is installed in the accessory housing, either alone or in combination with other radio accessory options. The installation instructions provided here apply when the encoder is the only accessory. For instructions pertaining to multiple option installations, refer to the installation instructions supplied with the housing assembly.

3.2.1 Field Installation of Multiple PL Encoder Board

Step 1. Remove the escutcheon backing and apply carefully to the housing assembly front panel. Use care to align the holes in the escutcheon with the holes in the panel.

Step 2. If the multiple PL encoder is used without a full complement of PL tones, the unused pushbutton switches must be pinned, as follows:

- (1) Pull the applicable pushbutton plastic cover straight off. A screwdriver may be used to give added leverage.
- (2) Install the supplied plastic pushbutton stop.
- (3) Push the cover back on the pushbutton switch.

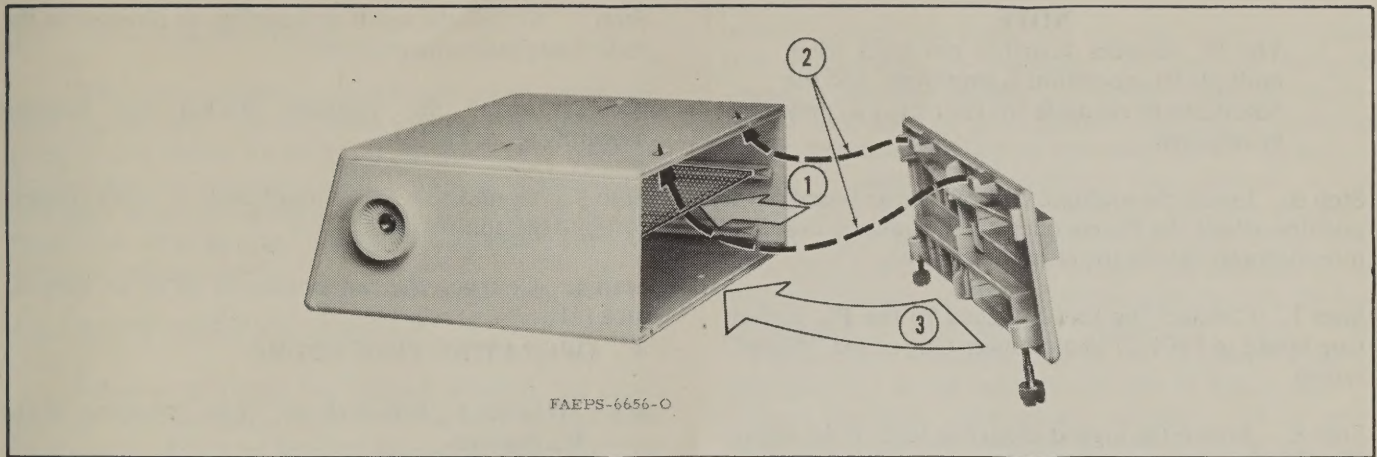
CAUTION

Be sure not to close the switch when replacing the pushbutton cover. Hold the little male slider pin that protrudes from the back of the switch with a small screwdriver and push the cover on. This slider pin is "in" when the switch is "open".

Step 3. Place the card into the two rails as shown in Figure 1 and slide the circuit card completely into the housing assembly.

Step 4. Determine which of the knockout panels in the rear housing cover must be removed to allow access to the 22-pin assembly on the board. Remove the panel by pushing it out toward the rear of the cover.

Step 5. Refer to Figure 1. Install the rear housing cover by (1) inserting the tabs on the top of the cover into the holes in the top of the housing assembly and (2)



*Figure 1.
Circuit Board Card and Rear Cover Installation Detail*

swinging the cover down against the bottom and (3) securing it with the two captive screws.

Step 6. Disconnect the black connector (P1101) from the control head.

Step 7. Use the contact removal tool to remove the following wires, with pins attached, from P1101.

- (1) Yellow wire from position 1.
- (2) Black-violet wire from position 9.
- (3) Black-orange wire from position 22.

NOTE

Steps 8 and 9 are not necessary when the wires extend at least five inches beyond the sleeving on the multiconductor cable.

Step 8. Remove the "S" clamp from the end of the multiconductor cable and move the strain relief back about five inches from the ends of the wires.

Step 9. Cut and remove the cable sleeving so that approximately five inches of the wires are exposed. Be careful not to cut the insulation of the wires. Hook the strain relief "S" hook to the bracket on the option housing.

Step 10. Insert the pins and wires which were removed from P1101 into the tan connector (P1) as follows:

- (1) Yellow wire into position 13.
- (2) Black-violet wire into position 12.
- (3) Black-orange wire into position 22.
- (4) Violet wire into position 18.

Step 11. Insert the pins and wires connected from P1 into P1101 as follows:

- (1) Yellow wire into position 1.
- (2) Black-violet wire into position 9.
- (3) Black-orange wire into position 22.

Step 12. Reconnect P1101 to the control head and connect P1 to the 22-pin receptacle (J1) on the rear of the circuit card.

3.2.2 Field Installation of Multiple PL Conversion Board

Step 1. Unlock the "Micor" radio set and pull the handle forward.

Step 2. Disconnect the power/control connector (P1105) and antenna connector.

Step 3. Lift the radio set out of the vehicle. (The bottom cover will remain mounted in the vehicle.)

Step 4. If the associated radio set is a "carrier squelch only" model, the PL enable jumper on the exciter board must be cut. This jumper is used to connect exciter pin P902-8 to pin P902-10 and can be located by referring to the exciter circuit board detail contained within the respective radio set instruction manual. Note that on PL radios, the PL enable jumper is already cut.

Step 5. If the associated radio set is a "Private-Line" model, remove the PL encoder board from the radio set by loosening the two captivated mounting screws which hold the board in place.

NOTE

The PL encoder board is not used when multiple PL operation is employed, and the board can be set aside for future use as may be required.

Step 6. Install the multiple PL conversion board in the position where the PL encoder in PL radios is normally mounted and tighten the mounting screws.

Step 7. Connect the lead attached to the PL conversion board to P901-27 (main power plug of the "Micor" radio).

Step 8. Attach the lugged capacitor lead to the mounting screw located near P901-27.

Step 9. Reinstall the radio set in the vehicle.

3.3 FACTORY WIRED OPTION

When the encoder option is purchased as part of a radio system, the wiring changes will have been completed. The individual system components are shipped with all interconnecting cables attached, to permit a thorough system checkout before unpacking. To install the radio system proceed as follows:

Step 1. Install the radio and cabling as directed in the radio installation instructions.

Step 2. Install the trunnion bracket and housing assembly as instructed.

Step 3. Connect the black (and blue, if used) connector(s) to the control head.

Step 4. Connect the tan connector (P1) to encoder jack (J1).

4. OPERATING PROCEDURE

4.1 To select a "Private-Line" tone, press one of the PL buttons.

4.2 To change PL tones, press another PL tone button. The previously selected tone button will automatically disengage.

4.3 To turn the PL encoder off, press the OFF button.

5. FUNCTIONAL OPERATION

5.1 Refer to the multiple PL encoder block diagram, Figure 2. The encoder may be divided into four major sections.

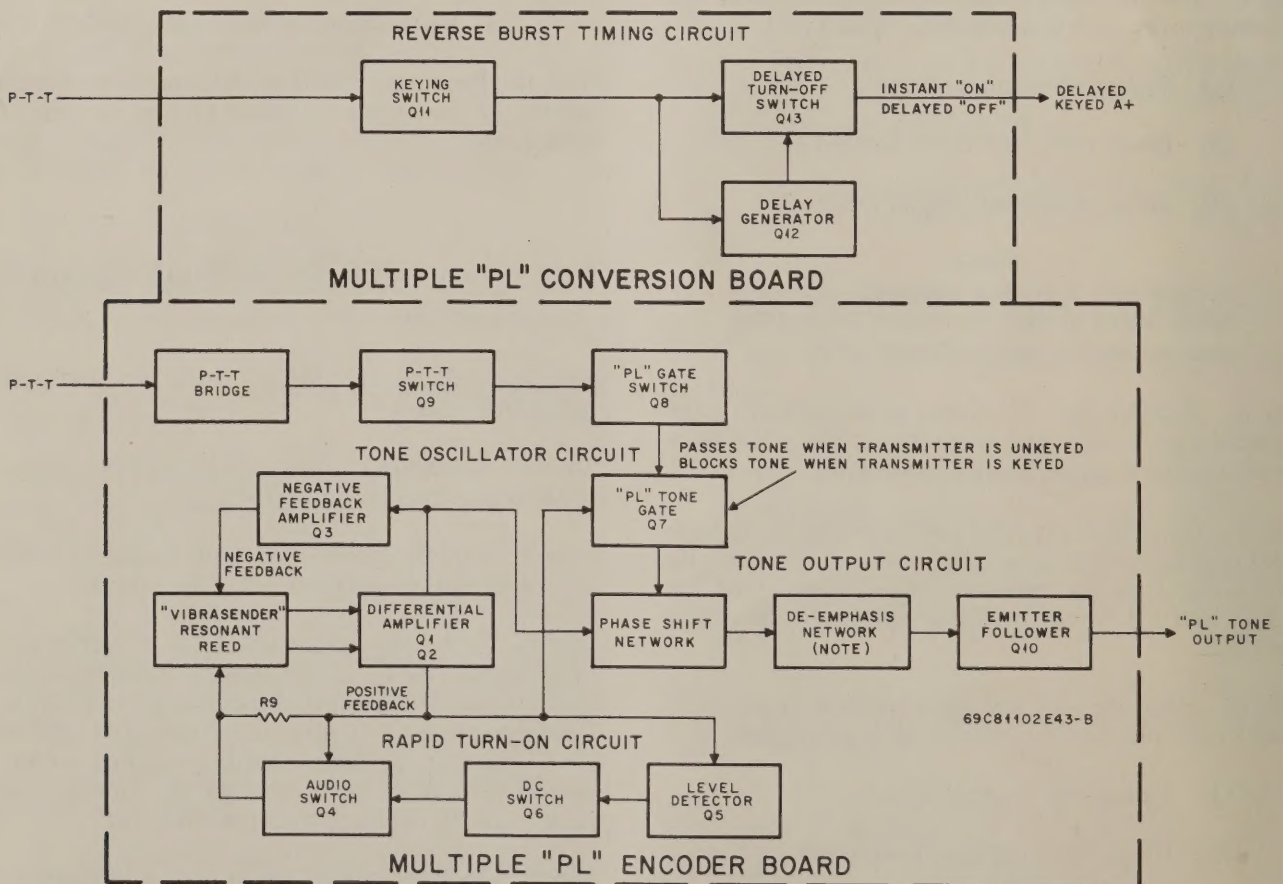


Figure 2.
Multiple "Private-Line" Encoder Block Diagram

5.2 TONE OSCILLATOR

The tone oscillator generates two equal amplitude tone signals 180 ° out-of-phase whenever power is applied to the radio. Differential amplifiers Q1 and Q2 provide the out-of-phase signals. Feedback amplifier Q3 provides negative feedback to limit the level of oscillation. The "Vibrasender" resonant reed determines the frequency of operation.

5.3 RAPID TURN-ON CIRCUIT

When a "Private-Line" tone is selected, the rapid turn-on circuit minimizes delay in reaching normal tone level output. The level detector Q5 senses the level of the tone output from the differential amplifier. At a low level, the level detector biases off the dc switch Q6 which in turn allows the audio switch Q4 to turn on. This provides very high positive feedback to the oscillator for a rapid increase in amplitude. When the amplitude of oscillation reaches a preset level, the entire rapid turn-on circuit is disabled until a change in "Private-Line" tone is made.

5.4 REVERSE BURST TIMING CIRCUIT

The reverse burst timing generator provides a transmitter turn-off delay of approximately 150 milliseconds after the transmitter is unkeyed. During this period, an opposite phase tone (reverse burst) is developed in the tone output circuit which dampens the oscillations of the "Vibrasponder" resonant reed in listening receivers to eliminate "squelch tail" noise burst at the end of the message. When the keyed filtered A+ is applied, keying switch Q11 and delayed turn-off switch Q13 operate immediately to key the transmitter. Delay generator Q12 is also activated. When the transmitter is unkeyed, delay generator Q13 keeps delayed turn-off switch Q13 activated for approximately 150 milliseconds.

5.5 TONE OUTPUT CIRCUIT

The tone output circuit provides a fixed level tone output to the modulator of the transmitter. The phase of the tone is shifted during the reverse burst period. When the transmitter is keyed, PL tone gate Q7 is switched off. Therefore, a single input to the phase network produces a specific phase output signal through emitter follower Q10. When the transmitter is unkeyed, PL tone gate Q7 switches on which allows both tone signals to be applied to the phase network. With both signals applied, the phase network develops a signals 240 ° out-of-phase. This is the proper signal to rapidly dampen the "Vibrasponder" resonant reeds.

6. CIRCUIT DESCRIPTION

6.1 TONE OSCILLATOR

6.1.1 The tone oscillator operates when a PL tone is selected. The outputs at the collectors of differential amplifiers Q1 and Q2 are identical but 180 °

out-of-phase. The amplitude of these collector signals are independent of frequency. A positive feedback signal is coupled through C5 and R9 to sustain oscillation. The output of Q1 is applied to feedback amplifier Q3 as negative feedback to limit the level of oscillation. When the signal level exceeds a fixed amount, Q3 is biased into operation. It provides a negative feedback signal which keeps the oscillator out of limiting, thus providing a sinusoidal wave output. Q3 operates as an emitter follower, providing current gain to drive the low impedance "Vibrasender" resonant reed. The "Vibrasender" resonant reed is the frequency determining device of the oscillator. It acts as a very high Q, narrow bandpass transformer, coupling only its resonant frequency and blocking all others. At its resonant frequency, the reed vibrates to couple energy from the primary to the secondary winding.

6.1.2 The "Vibrasender" resonant reed is a precision built device which maintains its frequency within $\pm 0.15\%$ of that specified. It consists of a tuned cantilever reed of special steel mounted on a rugged base with a coil and two permanent magnets. The entire assembly is spring-mounted and hermetically sealed in a metal housing to insure long life at peak performance under all types of conditions. The design of the reed eliminates the need for servicing throughout its useful life. The reed is a plug-in device which may be easily removed and replaced for circuit testing or to change frequencies. Reeds are available in specific frequencies in the 67-210 Hz range. No circuit adjustments are required when changing reeds.

NOTE

"Private-Line" tone frequencies are assigned by Motorola Systems Engineering to prevent duplication or interference between tones in the same area. Consult them before changing frequencies.

6.2 RAPID TURN-ON CIRCUIT (Q5, Q6, Q7)

When level detector Q5 senses a tone output level of less than 6 dB of full output, it is biased off. This turns on DC switch Q6, which turns on the audio switch Q4. Positive feedback is provided through saturated Q4 for a rapid increase in amplitude of the selected tone. When the tone output reaches a level of approximately 6 dB below full output, level detector Q5 is biased on. This, in turn, turns off DC switch Q6 which biases off Q4 through R12 and CR2. This permits normal oscillator operation.

6.3 TONE OUTPUT CIRCUIT (Q7 THRU Q10)

6.3.1 When the PTT lead is grounded (transmitter keyed), the PTT switch Q9 turns on. The PTT bridge, together with the jumper connected to point B (positive ground systems) or point A (negative ground systems), permit Q9 to turn on with either negative or positive grounded systems. Q9, in turn, allows PL gate switch Q8 to turn on. Q8 gates 10 volts to PL tone gate

Q7, turning it off. Q7 remains off during transmission and permits only the tone output of Q1 to be coupled to emitter follower Q10.

6.3.2 When the PTT lead is ungrounded (transmitter unkeyed), PTT switch Q9 turns off. Q9, in turn, biases off PL gate switch Q8 and allows PL tone gate Q7 to conduct. The tone outputs of Q1 and Q2, 180 degrees out-of-phase, are combined through phase shift capacitors C8 and C9 to produce a signal 240 degrees out-of-phase. The signal is placed at the input of emitter follower Q10. Emitter follower Q10 provides impedance matching to a low impedance output and isolates the tone oscillator from the external circuit to which the tone output is applied.

6.3.3 The modulator of VHF radios has a +6 dB per octave pre-emphasis characteristic. To maintain 0.5 to 1 kHz PL tone deviation of the transmitter signal, C10 (not used on UHF models) at the base of Q10 provides a compensating -6 dB per octave de-emphasis. The modulator of UHF Micor radios has a flat characteristic, so the -6 dB per octave de-emphasis is not required.

6.4 REVERSE BURST TIMING CIRCUIT (Q11, Q12, Q13)

When the transmitter is keyed, keying switch Q11 is forward biased by the keyed filter A+ voltage on its base and it turns on. With Q11 acting as a short circuit:

- A conduction path is established from A- through Q11, CR9, and R42 to A+. Most of the voltage drop is across R42, placing both the cathode and anode of CR9 at approximately A-.

- The base voltage of delayed turn-off switch Q13 decreases and it is turned on.

- Delayed keyed filtered A+ is developed to key the transmitter.

- C14 charges.

- A- is applied to the PL tone gating circuit to turn off the PL tone gate.

When the transmitter is unkeyed, keyed filtered A+ is removed from Q11 and it turns off. With Q11 turned off:

- The PL tone gate Q7 is re-activated, allowing the reverse burst tone signal to pass.

- C708 discharges and turns Q12 off for approximately 150 milliseconds.

- Q13 remains on by receiving base drive through R39 and R40 for the 150 milliseconds that Q12 remains off.

— After the delay period, Q12 turns on, Q13 turns off and the delayed keyed filtered A+ output is removed.

7. SERVICING

7.1 Maintenance of the mobile multiple PL encoder falls into two areas: testing and troubleshooting. Testing is performed either in-system or on the service bench.

NOTE

When checking PL tones, refer to the circuit board detail for location of the proper "Vibrasender" resonant reed.

7.2 ISOLATE BOARDS

7.2.1 The first step in testing the multiple "Private-Line" encoder is to determine whether the PL encoder board or the PL conversion board is defective. If the conversion board is believed to be defective, it is best to replace the board with an operational board. This is because it is difficult to take readings from the conversion board while mounted in the radio. For checkout, the conversion board can be replaced with either another conversion board or a single frequency PL encoder. If proper operation of the radio set is restored by replacing the conversion board, troubleshooting can be accomplished with the aid of an ohmmeter.

7.2.2 Removal and installation of the conversion board is accomplished as follows:

Step 1. Unlock the "Micor" radio set and pull the handle forward.

Step 2. Disconnect the power/control cable (P1105) and antenna connector.

Step 3. Lift the radio set out of the vehicle. (The bottom cover will remain mounted in the vehicle.)

Step 4. Disconnect the lead from P901-27. (This lead is connected to the PL conversion board and is terminated in a push-on type pin.)

Step 5. Loosen the two mounting screws holding the PL conversion board.

Step 6. Pull out the present PL conversion board.

Step 7. If checkout is being done with a single frequency PL encoder board, slide the board into the radio set and tighten the mounting screws.

Step 8. If checkout is being done with a PL conversion board, slide the conversion board into the radio set,

tighten the mounting screws, and connect the lead attached to the conversion board to P901-27.

Step 9. Replace the radio set in the vehicle and test for proper operation.

7.3 IN-SYSTEM TESTING OF ENCODER BOARD

Performing a checkout of the encoder board card while it is still connected to the radio system necessitates removing the circuit card from the "Systems 90" housing. This is accomplished as follows:

Step 1. Disconnect the tan connector from the circuit card.

Step 2. Loosen the two captive screws securing the rear housing cover and remove the cover.

Step 3. Slide the circuit card out of the housing assembly and place it atop the housing with the solder side up.

Step 4. Reconnect the tan connector to the circuit card.

CAUTION

Do not allow the circuit card to come into contact with any metallic object which may cause damage from an accidental short circuit.

Step 5. Apply power to the system and proceed to take the voltage measurements necessary to isolate the source of the problem.

7.4 BENCH TESTING

7.4.1 Bench testing allows the radio system to stay "in-service" by substituting an operational circuit card for a defective one, while the malfunction is corrected on the service bench. The following equipment is required for a thorough circuit checkout.

- (1) DC power supply
- (2) Service bench VTVM
- (3) Service bench oscilloscope
- (4) One short jumper wire terminated in alligator clips.

7.4.2 To perform the bench check proceed as follows:

Step 1. Remove the tan connector from the rear of the circuit card.

Step 2. Loosen the captive screws securing the rear housing cover and remove the cover.

Step 3. Remove the circuit card from the housing.

Step 4. Set up the circuit card as shown in Figure 3.

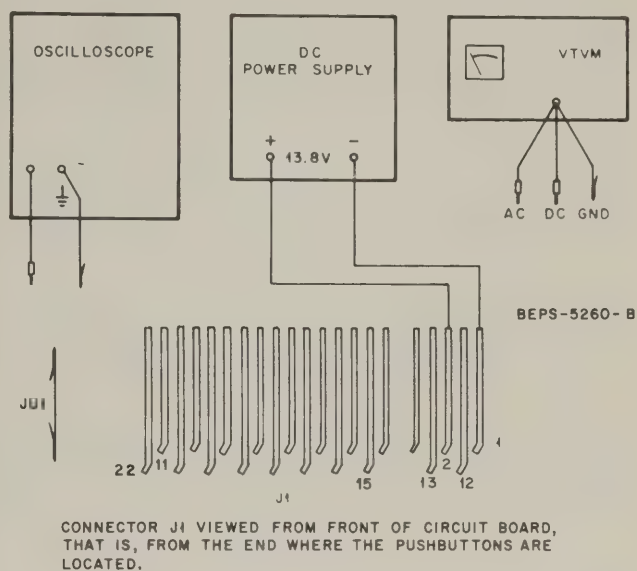


Figure 3.
Bench Test Set-Up

Step 5. Apply power to the system and proceed to take the voltage measurements necessary to isolate the source of the problem.

7.5 TROUBLESHOOTING

A troubleshooting chart is provided as an aid in isolating the cause of any malfunction attributed to the encoder circuits. This chart presents a logical sequence of steps which result in isolating a faulty component or circuit. Refer to this chart when attacking any problem caused by this unit.

7.6 REPAIR

Any component on the circuit card can be replaced by following accepted repair procedures. Refer to the "Micor" radio instruction manual for information pertaining to ordering replacement parts. Upon completion of repairs, the circuit card is reinstalled as follows:

Step 1. Disconnect the tan connector from the circuit card.

Step 2. Slide the card completely into the housing.

Step 3. Install the rear housing cover and secure with two captive screws.

Step 4. Reconnect the tan connector to the circuit card.

COMMERCIAL WARRANTY (STANDARD)

Motorola radio communications products are warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR, (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts, including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola Communications and Electronics, Inc., 1301 E. Algonquin Road, Schaumburg, Illinois 60196, to the original purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by seller, or if appropriate, to specifications accepted by Seller in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof, and such action on the part of Motorola shall be the full extent of Motorola's liability hereunder.

This warranty is void if:

- a. the product is used in other than its normal and customary manner;
- b. the product has been subject to misuse, accident, neglect or damage;
- c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

This warranty extends only to individual products, batteries are excluded, but carry their own separate limited warranty. Because each radio system is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty except by a separate written agreement signed by an officer of Motorola.

Non-Motorola manufactured products are excluded from this warranty, but subject to the warranty provided by their manufacturers, a copy of which will be supplied to you on specific written request.

In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-27734-O



A rectangular box containing the text "CHECK CONVERSION BOARD FOR PROPER DELAY". An arrow points down to this box from a horizontal line that extends from the left margin.

CHECK CONVERSION BOARD
FOR PROPER DELAY

DEPS-5264-O

*Multiple PL Encoder Board
Troubleshooting Chart
Motorola No. DEPS-5264-O
8/15/79- PHI*

**COMMERCIAL WARRANTY
(STANDARD)**

Motorola radio communications products are warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR, (except for crystals and channel elements which are warranted for a period of ten (10) years) from the date of shipment. Parts, including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola Communications and Electronics, Inc., 1301 E. Algonquin Road, Schaumburg, Illinois 60196, to the original purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by seller, or if appropriate, to specifications accepted by Seller in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof, and such action on the part of Motorola shall be the full extent of Motorola's liability hereunder.

This warranty is void if:

- a. the product is used in other than its normal and customary manner;
- b. the product has been subject to misuse, accident, neglect or damage;
- c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

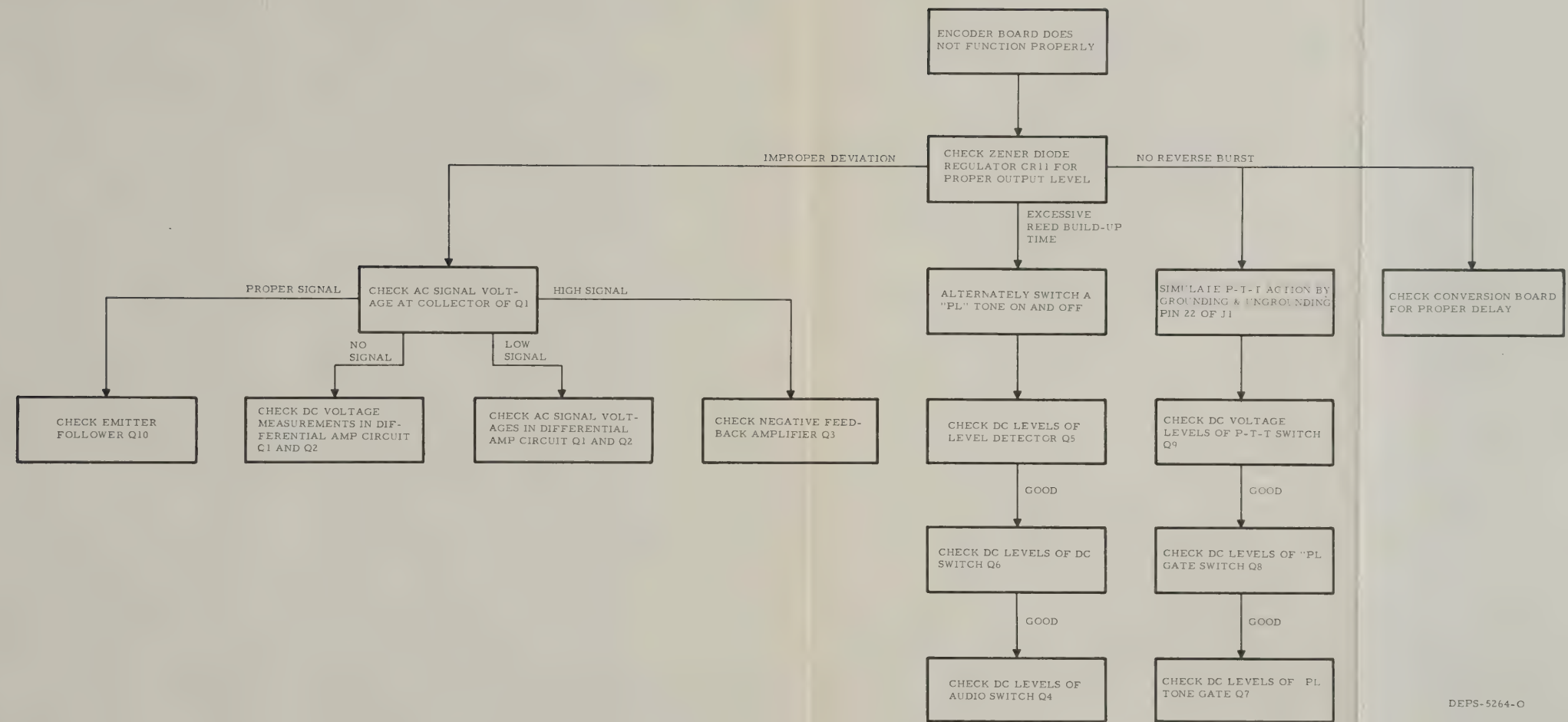
This warranty extends only to individual products, batteries are excluded, but carry their own separate limited warranty. Because each radio system is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty except by a separate written agreement signed by an officer of Motorola.

Non-Motorola manufactured products are excluded from this warranty, but subject to the warranty provided by their manufacturers, a copy of which will be supplied to you on specific written request.

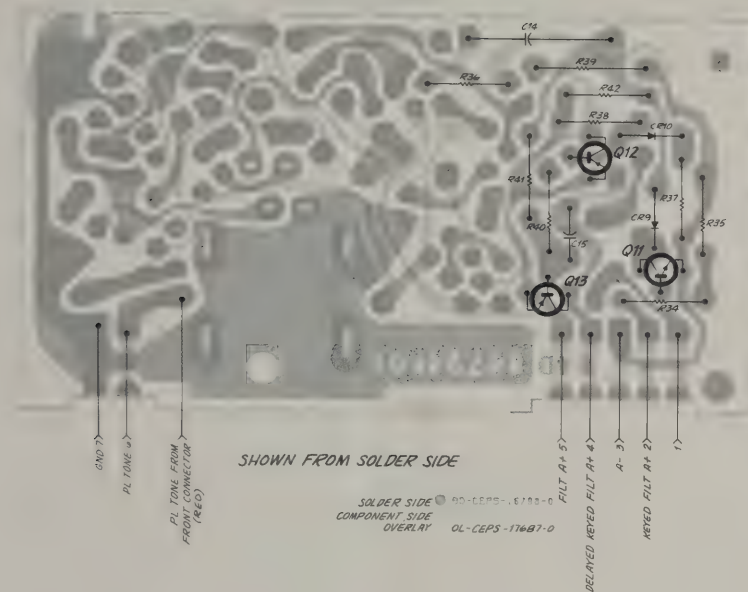
In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-27734-O



PL CONVERSION BOARD



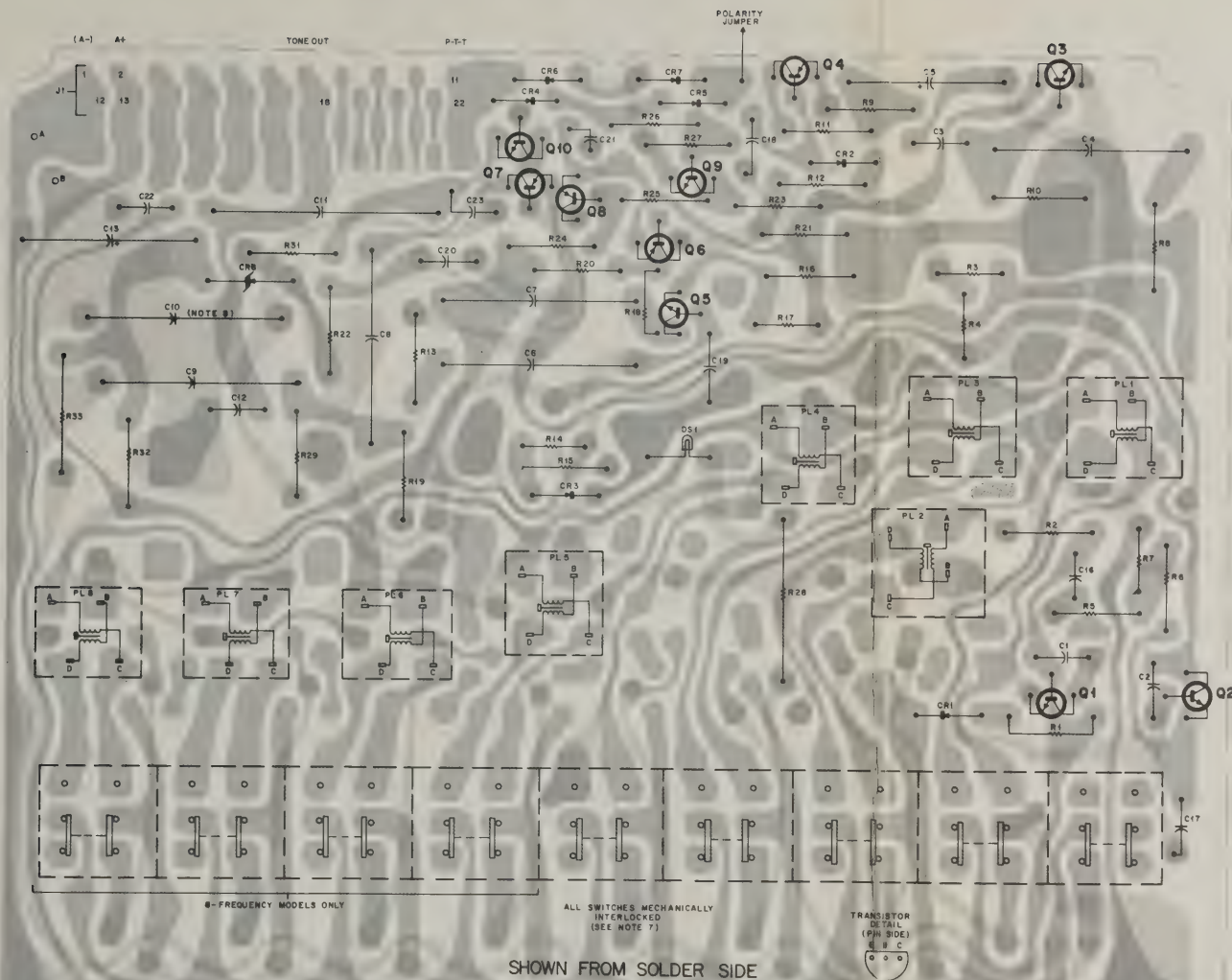
SHOWN FROM SOLDER SIDE

SOLDER SIDE
COMPONENT SIDE
OVERLAY

Multiple "Private-Line" Encoder & "PL" Conversion Board
Schematic Diagram & Circuit Board Detail
Motorola No. PEPS-17676-B
(Sheet 1 of 2)
8/15/79- PHI



MULTIPLE PL ENCODER BOARD



SHOWN FROM SOLDER SIDE

SOLDER SIDE
COMPONENT SIDE

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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PARTS LIST

TLN4527A Multiple PL Encoder (4-tone) Low Band and
TLN4528A Multiple PL Encoder (8-tone) High Band
TLN5154A Multiple PL Encoder (4-tone) UHF Band
TLN5155A Multiple PL Encoder (8-tone) UHF Band PL-3389-O

C1, 2, 12	21-82187B20	CAPACITOR, fixed: .001 uF ±10%; 100 V
C3, 16 thru 23	21-82187B21	820 pF ±10%; 200 V
C4	8-83813H11	0.22 uF ±10%; 75 V
C5	23-83214C02	15 uF ±20%; 25 V
C6, 7	8-82317B01	0.1 uF ±10%; 100 V
C8	8-868594	0.22 ±10%; 100 V
C9	8-852472	.022 ±10%; 200 V
C10	8-868588	.068 ±10%; 100 V (not used on UHF)
C11	23-82645A04	3.5 uF ±100-10%; 20 V
C13	23-83214C07	22 uF ±20%; 15 V
CR1 thru 3	48-83654H01	SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR4 thru 7	48-82420C01	silicon
CR8	48-82256C11	silicon; Zener type; 10 V
J1		CONNECTOR, receptacle: (for reference only)
J401		(for reference only)
J902		(for reference only)
J1101'		(for reference only)
JU1	1-80718B31	LEAD, electrical: "jumper"; includes 39S10184A07 CONNECTOR, plug; female; single-contact
P401		CONNECTOR, plug: (for reference only)
P901		(for reference only)
P902		(for reference only)
P1105		(for reference only)
Q1, 2	48-869570	TRANSISTOR: (SEE NOTE)
Q3, 5, 9, 10	48-869642	NPN; type M9570
Q4, 6, 7, 8	48-869643	NPN; type M9642
		PNP; type M9643
R1, 31	6-124A65	RESISTOR, fixed: ±10%; 1/4 W; unl. stated
R2, 12, 21, 23	6-124A73	4.7k ±5%
R3, 4	6-185A51	10k ±5%
R5, 6	6-124A01	1.2k ±5%; 1/8 W
R7	6-185A41	.10 ±5%
R8, 20, 24, 25	6-124A89	470 ±5%; 1/8 W
R9	6-124A71	47k ±5%
R10	6-124A85	8.2k ±5%
R11	6-124A25	33k ±5%
R13	6-124A77	100 ±5%
R14	6-185A61	15k ±5%
R15	6-124A97	3.3k ±5%; 1/8 W
R16	6-129431	100k ±5%
R17	6-185A65	180 ±5%
R18	6-185A97	4.7k ±5%; 1/8 W
R19	6-124A81	100k ±5%; 1/8 W
R22	6-124A75	22k ±5%
R26	6-124C47	12k ±5%
R27	6-124C39	820
R28	6-126C17	390
R29	6-124A91	47; 1 W
R30	6-124A33	56k ±5%
R32	6-124A05	220 ±5%
R33	6-125A33	15 ±5%
		220 ±5%; 1/2 W
SI	40-84324C06	SWITCH ASSEMBLY, push; interlocking action; lockout type; 5-section; each section dpdt; does not include 14C84360C01
	or 40-84324C07	INSULATOR, switch terminal: 5 req'd (4-tone encoder)
		5-section; each section dpdt; does not include 14C84360C01
		INSULATOR, switch terminal: 9 req'd (8-tone encoder)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
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XDS1	9-84285C01	LIGHT, indicator: 2-contact; white opaque screen; for wedge-base lamps
NON-REFERENCED ITEM		
	9-84910C01	SOCKET, "Vibrasender" Resonant Reed; includes integral mounting bracket

TLN5733A "PL" Converter (VHF Radios)
TLN5734A "PL" Converter (UHF Radios) PL-3302-O

C14	23-84762H09	CAPACITOR, fixed: 15 uF ±20%; 20 V
C15	21-82372C04	.05 uF ±80-20%; 25 V
C24	21-82187B14	.001 uF ±10%; 100 V
CR9, 10	48-83654H01	SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
		silicon
Q11	48-869642	TRANSISTOR: (SEE NOTE)
Q12	48-869643	NPN; type M9642
Q13	48-869328	PNP; type M9643
		PNP; type M9328
R34, 45	6-124C57	RESISTOR, fixed: ±5%; 1/4 W unless otherwise stated
R35	6-124C49	2.2k ±10%
R36, 41	6-124A53	1k ±10%
R37	6-124A77	1.5k
R38	6-124A75	15k
R39	6-124A49	12k
R40	6-124A45	1k; 1/2 W
		680

TKN6507A Cable Kit PL-3390-O

P1		CONNECTOR, plug: includes: 14-84556B08 HOUSING, connector (TAN) 9-84151B03 CONTACT, female; 6 req'd.
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TLN4514A and HLN4031A Hardware and Escutcheon Kit
(4 "PL" tone)
TLN4515A and HLN4032A Hardware and Escutcheon Kit
(8 "PL" tone) PL-3388-A

DS1	65-83554G01	LAMP, incandescent: 12 V; wedge base; type #161
NON-REFERENCED ITEMS		
	66-84690C01	TOOL, contact removal
	13-84319C16	ESCUTCHEON (4-tone encoder)
	13-84319C06	ESCUTCHEON (8-tone encoder)
	38-84321C01	PUSHBUTTON (white)
	38-84321C02	PUSHBUTTON (orange)
	38-84617C01	PUSHBUTTON, stop switch
	42-80088A01	CLIP, Mitrek Option (HLN4031A, 4032A only)

NOTE: For optimum performance, diodes and transistors must be ordered by Motorola part numbers.

HLN4030A Resistor Kit PL-6687-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R101	6-124A83	27k ±5% 1/4 W Replaces C9 on Encoder Board when used with MITREK radio.

MITREK™ /MICOR™ SYSTEM•90™
Multiple "Private-Line"
Mobile Encoder
Models TLN1837A-TLN1840A,
HLN1004A and HLN1005A

68P81106E95-C